AL-Fateh University Faculty of Engineering Electrical and Electronic Department

Fall 2010 – 2nd Midterm Exam **Signals & System (EE302)** Date: 27/12/2010 Time: 1:00 hrs

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Answer all questions:

Q1 – Given the following system [5]

$$y(t) = \int_{\tau=a}^{t} \left(\frac{\tau}{t}\right) \cdot X(\tau)\, d\tau$$

Check for time invariant & linearity

Q2 – Consider the continuous-Time system $(D^2 + 2D - 2)[y(t)] = 5x(t)$ [5]

a) Evaluate the frequency response of the system.
b) Find the output of the system when

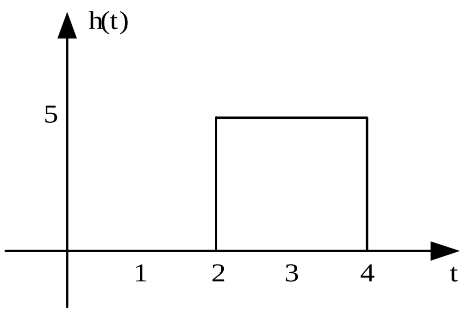
$$x(t) = e^{-3t} \qquad t \geq 0, \qquad y(0) = 1, y^{(1)}(0) = 0.$$

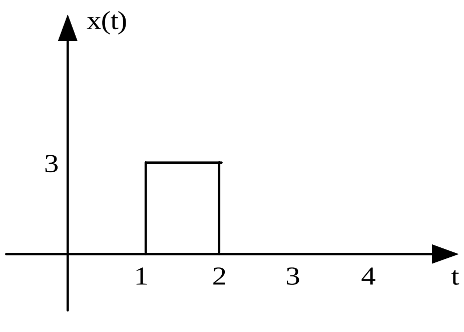
Q3 –Given the following transfer function [5]

$$H(z) = \frac{6(s+34)}{s\left(s^2 + 10s + 34\right)}$$

Evaluate the inverse of the given Laplace transform

Q4 - When the input to a continuous-Time system δ(t) the output is the shown h(t) find the output of the same system to the given input signal x(t). [5]





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Solution of Q1

$$y(t) = \int_{\tau=a}^{t} \left(\frac{\tau}{t}\right) \cdot X(\tau)\, d\tau$$

$$y(t)_1 = \int_{\tau=a}^{t} \left(\frac{\tau}{t}\right) \cdot X(\tau - t_o)\, d\tau$$

$$U := \tau - t_o$$

$$d\tau = du$$

$$y(t)_1 = \int_{u=a-t_o}^{u=t-t_o} \left(\frac{u + t_o}{t}\right) \cdot X(u)\, du$$

which is not equal to y(t-to)--------> time varying

Q2)

$$H(j\omega) = \frac{5}{(j\omega)^2 + 2(j\omega) - 2}$$

$$y^h(t) = c_1 e^{r_1 t} + c_2 e^{r_2 t} \qquad r_1 = -2.7321, \qquad r_2 = 0.7321$$

$$y^p(t) = 5e^{-3t}$$

$$y(t) = y^h(t) + y^p(t) = -5.1753e^{r_1 t} + 1.753e^{r_2 t} + 5e^{-3t} \qquad t \geq 0$$

Q3)

$$H(s) = \frac{6(s+34)}{s\left(s^2 + 10s + 34\right)} = \frac{6}{s} - \frac{3-4i}{s+5-3i} - \frac{3+4i}{s+5+3i}$$

$$k = -3 - 4i = 5\angle -126.869$$

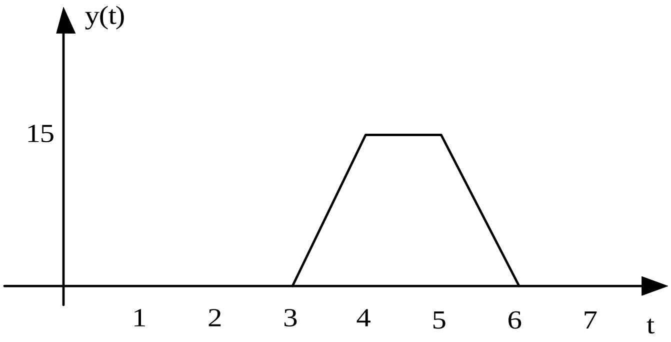
$$f(t) = \left[6 + 2\,|\,5\,|\,e^{-5t}\cos(3t + 126.9)\right]u(t)$$

$$H(s) = \frac{6(s+34)}{s\left(s^2 + 10s + 34\right)} = \frac{6}{s} - \frac{6(s+5)}{(s+5)^2 + 9} - \frac{8(3)}{(s+5)^2 + 9}$$

$$f(t) = \left[6 - 6e^{-5t}\cos(3t) - 8e^{-5t}\sin(3t)\right]u(t)$$

Q4)

$$y(t) = x(t) * h(t)$$


y(t)
15
1
2
3
4
5
6
7
t